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Building consensus on inpatient discharge pathway components in the management of blunt thoracic injuries: An e-Delphi study amongst an international professional expert panel

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IQR, Interquartile range
MDT, Multidisciplinary team
MTC, Major trauma centre
OPD, Outpatient department
OT, Occupational therapist
PT, Physiotherapist
SD, Standard deviation
VAS, Visual analogue scale

ABSTRACT

Introduction: Access to a standardised and evidence informed approach to blunt thoracic injury (BTI) management remains challenging across organised trauma systems globally. It remains important to optimise recovery through pathway-based interventions. The aim of this study was to identify components of care that are important in the effective discharge process for patients with BTI and pinpoint core and optional components for a patient pathway-based intervention.

Methods: Components of care within the hospital discharge process after BTI were identified using existing literature and expert opinion. These initial data were entered into a three-round e-Delphi consensus method where round one involved further integrating and categorising components of discharge care from the expert panel. The panel comprised of an international interdisciplinary group of healthcare professionals with experience in the management of BTI. All questionnaires were completed anonymously using an online survey and involved rating care components using Likert scales (Range: 1-6). The final consensus threshold for pathway components were defined as a group rating of greater than 70% scoring in either the moderate importance (3-4) or high importance category (5-6) and less than 15% of the panel scoring within the low importance category (1-2).

Results: Of 88 recruited participants, 67 (76%) participated in round one. Statements were categorised into nine themes: (i) Discharge criteria; (ii) Physical function and Self-care; (iii) Pain management components; (iv) Respiratory function components; (v) General care components; (vi) Follow-up; (vii) Psychological care components; (viii) Patient, family and communication; (ix) 'Red Flag' signs and symptoms. Overall, 70 statements were introduced into the consensus building exercise in round two. In round three, 40 statements from across these categorises achieved consensus amongst the expert panel, forming a framework of core and optional care components within the discharge process after BTI.

Conclusions: These data will be used to build a toolkit containing guidance on developing discharge pathways for patients with BTI and for the development of audit benchmarks for analysing healthcare provision in this area. It is important that interventions developed using this framework are validated locally and evaluated for efficacy using appropriate research methodology.

Background

Blunt thoracic injury (BTI) remains a common presentation to the emergency and trauma care setting and is associated with high levels of mortality and morbidity [1,2]. The development and evaluation of patient pathway-based interventions in the management of chest trauma is increasingly important in understanding how BTI is contemporaneously managed [3]. Anecdotal evidence

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has highlighted the lack of standardisation in practice by using pathway-based care, particularly in hospitals not designated as major trauma centres (MTC). One major challenge for non-MTCs are the availability of interventional components within the pathway (i.e. what might be available at one hospital, may not be readily available at another centre) indicating that a 'one fit' approach to pathway development is unlikely to be an effective model [3]. Rather, a 'toolkit' development framework with a 'how to build your own' approach is likely to effectively enable pathway building. In examples from outside trauma, the interventions developed have good local application, are more acceptable to patients and staff, and have overall greater efficacy in improving outcomes than care provided without pathway-based interventions [4–6].

There have been several in-depth reviews of the components of BTI management which have highlighted the complexity of including multiple interventions on the function of the overall pathway [7–10]. Unfortunately, there is little reported about the effectiveness of interventions for patients with primary BTI in both discharge and the immediate post discharge phase [11–14]. In the general trauma population, there is evidence to suggest that clinicians' poor understanding of the patient experience of pain hinders the effectiveness of hospital discharge processes in optimising post discharge pain experience and subsequent recovery after traumatic injury [15–17]. This suggests that interventions to optimise symptom management through the hospital discharge process and improve both patient and clinician education are likely to positively impact on patient experience and outcomes [13, 14, 17].

As decision-making surrounding the management of BTI varies substantially between trauma centres and clinician groups, it is important that in the development of patient pathway-based interventions that clinicians' opinions are explored, and a consensus is achieved prior to intervention development [18]. The aim of this study was to identify components of care that are important in the effective discharge process for patients with BTI and furthermore, by using the Delphi method to identify core and optional components of a novel discharge pathway for BTI. The outputs from this study will be used firstly to create a toolkit/guideline for building BTI discharge pathways in different settings, and secondly, these component outputs can be formulated to create audit benchmarks for local discharge processes and more widely as part of trauma centre peer-reviews.

Methods

Study design and setting

A three round online Delphi technique was employed with the aim of establishing consensus on core and optional patient pathway components for the development of a Blunt Chest Injury Discharge Pathway Toolkit. This Delphi study was developed, conducted and reported using best practice Guidance on Conducting and Reporting Delphi Studies (CREDES) [19]. A protocol was developed *a priori* describing the full consensus method. Ethics approval for this Delphi study was obtained from King's College London Research Ethics Committee using minimal risk registration (MRSP-19/20-19847) and approval was given on 19/06/2020. Fig. 1 presents an overview of the Delphi method process utilised within this study.

Development of Delphi statements

Prior to undertaking this Delphi study, preparation stages were undertaken to ensure that underlying pathway knowledge and a broad range of evidence was sourced and represented within the consensus process. These preparations were achieved through a review of the published existing literature and accessing informed opinions from healthcare professionals and trauma patients. These data were integrated with data compiled from round one of the Delphi study to create an exhaustive list of pathway components. Participants were given the opportunity to suggest additional statements that had not been included from round one during subsequent rounds of the consensus exercise.

Delphi study participants and consent

The initial aim was to have 60-80 participants recruited to the study prior to commencing round one to account for potential loss to follow-up with approximately 40 participants completing each round of the study. Recruitment was undertaken over a four-week period in July 2020. The expert consensus panel was constructed from international interdisciplinary groups of trauma healthcare professionals. Non-registered healthcare professionals and members of the public were excluded from participating in the study. Initial recruitment was undertaken from the 'Pan-London Trauma Network' Rib Injury working group and through social media through the Twitter platform. Potential participants were sent an invite and asked to sign up through a survey portal. Only an email address was taken from participants during sign up, and no identifiable information was taken from participants throughout the Delphi process. All prospective participants were provided with access to a downloadable participant information sheet. Participants were made aware that consent was assumed by the submission of the questionnaire in each round and that the withdrawal of data was not possible after submission of a questionnaire due to the anonymous questionnaire submission process.

Questionnaire development processes

In the three rounds of this Delphi study, all surveys were developed and presented through the platform SurveyMonkey. The process was led by EB and all questionnaires were developed iteratively through a process of consultation and feedback between authors. To ensure consistent high quality within the survey instrument, questionnaires at all rounds were piloted and revised with feedback from a small external steering group (n=4) including three patient and public reference group members and one healthcare professional. This group piloted each questionnaire and provided feedback on the comprehensibility of the questionnaire and usefulness of the response options.

Round one

In the first round, three broad open-ended questions/instructions were presented to the expert consensus group. Participants were asked to give up to ten answers for each question:

1 'Using your clinical experience, please list the components of care that you think should be included in a blunt chest trauma discharge pathway.'
2 'Using your clinical experience, please list important content topics to be included in patient facing education material that can be used to advise patients on self-management of recovery after discharge.'
3 'Using your clinical experience, please list the important 'Red Flag' signs and symptoms for patients with blunt chest injuries to be aware of in the early post discharge period that would need further medical input.'

All recruited participants were provided with access to the survey via a web-link and a QR code. The survey portal was open

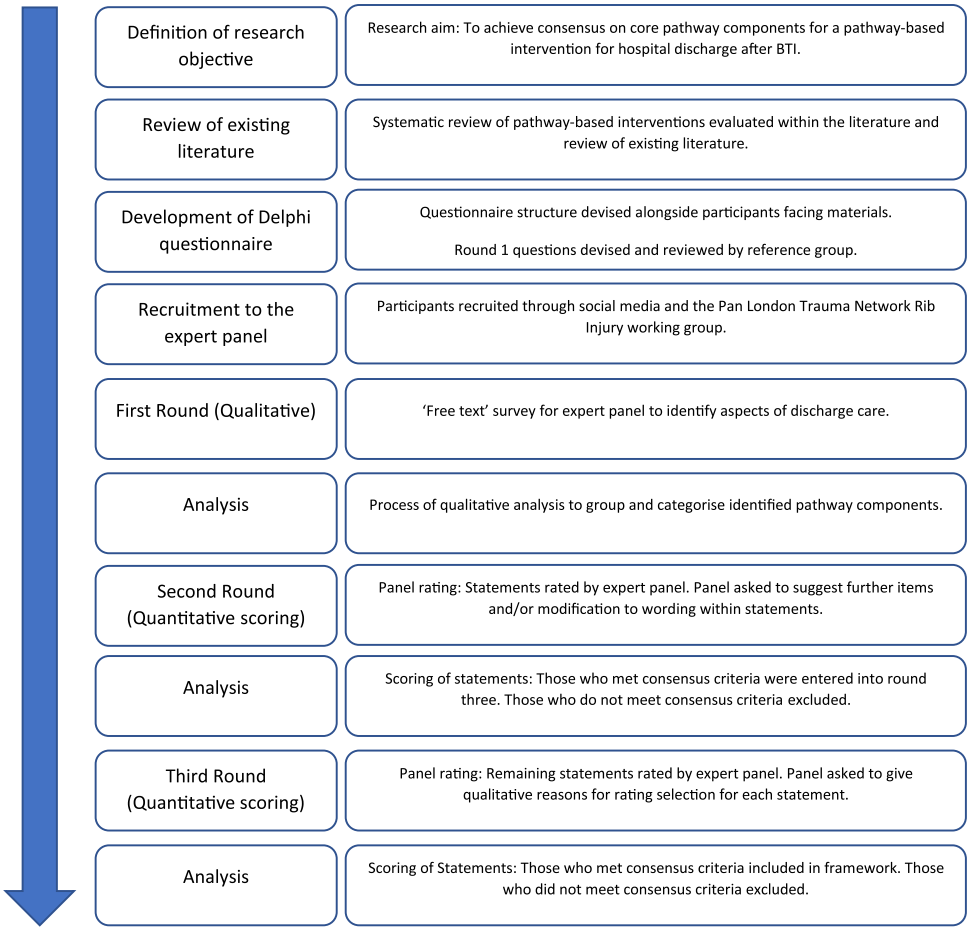

Fig. 1. Process map for Delphi method.

for two weeks and reminders were sent out to all participants between 5-7 days and 24 hours prior to closing. Findings were collated and categorised into themes and sub-themes. Any disagreement between findings were discussed between EB and GL and an agreement achieved.

Rounds two & three

After pathway components were integrated and collated, subsequent questionnaires were developed to enable the scoring of levels of importance participants associated with specific statements. In these rounds, the response format was a six-point Likert scale:

- 1 or 2: Low importance (this statement will not be included in the final pathway).
- 3 or 4: Moderate importance (these statements will be optional and may be included).
- 5 or 6: High importance (these statements will become core components of the pathway).

Participants were asked to score the importance of a particular statement using the above scale. Where participants felt unable to score a statement, there was also an 'unable to score' option within each statement. Participants were also asked to note down comments and reasons behind their quantitative decisions in a free text box associated with each statement. After rounds two and three, feedback of both qualitative and quantitative findings were presented back to all participants. Participant instructions for round three asked participants to reflect on the feedback from round two and consider whether the group rating had influenced the way they would score the statement. In all participant facing materials, the importance of consistent participation throughout all rounds was stated, highlighting the potential impact on validity and the over-estimation of consensus (i.e. reaching consensus at a sample level but not at a population level).

Data analysis

Descriptive statistical analysis was undertaken after rounds two and three including median and Interquartile Range (IQR) (the sum of the difference between quartile 3 and quartile 1 will be presented), and frequency/percentage of participants scoring each category for each statement [20]. Qualitative comments were categorised and used to increase understanding of the attitudes of participants towards the importance of included statements. Secondly, qualitative comments were used to refine and revise the language used within the statement at each phase of the study.

Consensus definition

Although there is variability in how consensus is defined within the Delphi method, there is a need for a clearly identified consensus definition. In this study, the level of consensus incrementally increased from Round 2-3 demonstrating the move towards achieving a stable consensus amongst participants. The Round 2 consensus definition was broadly based on Ingoe et al. [21]:

- Consensus was achieved if 50% or more of the participant group rated an item 'High importance' (5-6) or 'Moderate importance' (3-4) and less than 15% rated an item as 'Low importance' (1-2).

Table 1
Characteristics and demographics.

	Round 1 n=67 (%)	Round 2 n=46 (%)	Round 3 n=48 (%)
Profession			
Doctor	32 (48)	23 (50)	21 (44)
Nurse	13 (19)	8 (17)	4 (8)
Physiotherapist	16 (24)	12 (26)	17 (35)
Advanced Clinical Practitioner	3 (4)	-	3 (6)
Other	3 (4)	3 (7)	3 (6)
Speciality			
Anaesthetics	5 (7)	5 (11)	3 (6)
Cardiothoracic/Thoracic	4 (6)	2 (4)	1 (2)
Critical care/Outreach	5 (7)	5 (11)	6 (12)
Emergency Care	28 (42)	16 (35)	15 (31)
General Surgery	-	-	1 (2)
Major Trauma Care	11 (16)	11 (24)	15 (31)
Orthopaedics	1 (1.5)	-	1 (2)
Trauma Co-ordination	6 (9)	2 (4)	2 (4)
Trauma Surgery	-	-	-
General Medicine	1 (1.5)	2 (4)	1 (2)
Elderly Care Medicine	2 (3)	2 (4)	2 (4)
Other	4 (6)	1 (2)	-
Country			
United Kingdom	57 (85.5)	41 (89)	38 (79)
Australia	5 (7)	2 (4)	7 (15)
Ireland	2 (3)	1 (2)	1 (2)
New Zealand	1 (1.5)	1 (2)	1 (2)
South Korea	1 (1.5)	1 (2)	1 (2)
United Arab Emirates	1 (1.5)	-	-
Years of Experience			
Mean Years (SD) (Range)	13 (±7.7) (1-42)	11 (±6.3) (1-27)	11 (±6.8) (1-28)
Hospital designation			
Major Trauma Centre	34 (51)	29 (63)	33 (69)
Trauma Unit	27 (40)	14 (30)	13 (27)
Local Emergency Hospital	4 (6)	1 (2)	-
Pre-hospital Care	2 (3)	2 (4)	2 (4)

- Consensus was also achieved if 50% or more of the participant group rated an item 'Low importance' (1-2)

All items that did not satisfy these criteria did not achieve consensus and were therefore not included in round 3.

The Round 3 consensus definition was broadly based on Ingoe et al. [21]:

- Consensus was reached if 70% or more of the whole participant group rated an item 'High importance' (5-6) or 'Moderate importance' (3-4) and less than 15% rated an item 'low importance' (1-2).
- Consensus was also reached if 70% or more of the participant group rated and item 'Low importance' (1-2)

All items that did not satisfy these criteria did not achieve consensus and were therefore not included in the final pathway toolkit. In the event of unclear stability within statement consensus, the IQR was used with a IQR value of $\leq$1.0 indicating stable consensus within the group. An IQR of $\leq$1.0 indicates that more than 50% of all opinions fall on a certain point on the scale. An IQR of zero, indicated perfect consensus, and the higher the IQR value, the greater the level of dispersion of the data from the median value [22].

Results

Three rounds of data collection were undertaken between August and October 2020. During the four-week recruitment period prior to data collection, 88 participants registered through the online survey portal. Round one and two took four weeks to complete (survey was open for two-weeks and analysis and feedback took two-weeks) and round-three was open for four weeks. Table 1 presents the characteristics of the participants over the three Delphi rounds.

First round results

The response rate in round-one was 76% (n=67) with an overall survey completion rate of 61% (i.e. the percentage of items within the survey completed). Participants recorded 250 combined statements relating to pathway components, 244 patient education topics and 208 potential 'Red Flag' signs and symptoms. These statements were analysed and categorised into nine themes including: (i) Discharge criteria; (ii) Physical function and Self-care; (iii) Pain management components; (iv) Respiratory function components; (v) General Components; (vi) Follow-Up; (vii) Psychological care components; (viii) Patient, family and communication; (ix) 'Red Flag' signs and symptoms. These findings were integrated with the empirical findings from the pre-Delphi preparations and a Delphi scoring questionnaire was developed for round-two.

Second round results

The second-round questionnaire was administered to the sample (n=88) and the survey portal remained open for two-weeks. This survey included 70 statements developed within the categories identified in round-one. Both qualitative and quantitative data from this round is presented in Supplementary file 1. The second round's response rate was 52% (n=46) with 38 fully completed surveys and an overall survey completion rate of 83%. Respondents included, 23 doctors, 8 nurses and 12 physiotherapists from a wide range of trauma relevant speciality areas. After analysis of results, 57 statements met the round-two criteria for consensus and were therefore taken forward to round-three. Of these, 48 statements achieved consensus in the 'High Importance' category (5 or 6) and therefore were deemed core pathway components, and nine statements achieved consensus in the 'Moderate Importance' category (3-4) and therefore were deemed optional pathway components. These statements were included in round-three. Participants feed-

back was developed alongside the third-round questionnaire using the qualitative and quantitative outputs from the round two questionnaire and this was presented back to the expert consensus panel in the round three questionnaire. Four additional statements were added to the 'Red Flag' signs and symptoms section of the round three questionnaire based on suggestions made by participants in round-two.

Third round results

The third-round questionnaire was administered to the sample (n=88) and due to the addition of feedback from round-two, the survey portal remained open for four-weeks to allow for the greater time burden on participants. This questionnaire included 61 statements transferred from round-two. Qualitative feedback from round-two was used to revise and update the language used in potentially ambiguous statements, but care was taken to ensure that these revisions did not change the underlying essence/meaning of the statement. Revised statements are included alongside the qualitative and quantitative feedback in Supplemental File 1. The third-round response rate was 55% (n=48) with 44 fully complete responses and an overall 92% survey completion rate. Respondents included 21 Doctors, 4 Nurses, 17 Physiotherapists and 3 Advanced Clinical Practitioners from a wide range of trauma related clinical specialities. After analysis of the responses to the round-three questionnaire, of 61 included statements, 40 achieved the round-three consensus definition. Of these, 35 statements achieved consensus in the 'High Importance' category (5 or 6) and therefore were deemed core pathway components, and five statements achieved consensus in the 'Moderate Importance' category (3-4) and were deemed optional pathway components. The statements which achieved consensus in round-three are presented in Table 2. These statements will become the core pathway components within the Blunt Thoracic Injury discharge pathway toolkit. Two statements (within the physical function and self-care category) had IQR of 2, highlighting potential instability in the level of consensus. All other statements had IQR of 1 or less representing stable consensus. Statements which did not achieve consensus at this level were discontinued and would not be included in the pathway toolkit. Excluded statements from rounds-two and -three are presented in Table 3.

Discussion

In this study, a three round Delphi consensus technique was conducted over a four-month period and consensus was achieved for 40 statements, with 35 statements subsequently becoming core pathway components within the RIOS pathway toolkit. These statements cover areas of BTI discharge practice including discharge criteria, physical function, pain management, respiratory function, general discharge considerations, follow-up, psychological care, and the patient, family and communication. A further section of statements of important 'Red Flag' signs and symptoms will be used to develop education materials for patients to take home. This process has demonstrated the change in participants' views towards consensus and stability as indicated by: Increasing percentage agreement, convergency of importance levels, and a decrease in qualitative comments in statements where consensus was achieved [20].

Reaching consensus on statements relating to safe discharge was the primary aim of this study, including the identification of post discharge sequelae and building statements which covered all key areas of patient safety in the discharge process after BTI. Initially 13 discharge criteria statements were developed within the pre-Delphi development phase and round-one. During round two and three, six statements were excluded as they did not achieve consensus, leaving seven statements included in the final selection. Similarly, within the 'Red Flag' signs and symptoms, four statements were excluded through round three and four, resulting in nine statements being included in the final statement framework. The included statements demonstrate the key subject areas for patient education materials for the early post discharge period. By selecting signs and symptoms that suggest that further medical care is required, it is likely that this educational framework will improve the patients' experience of self-management after discharge from hospital [23,24]. The results demonstrate that there is a good coverage of patient safety issues in each category [25].

There was an interesting trend within the round one group data where care components focused on specific components of BTI management whilst other areas were overlooked. One example of this relates to analgesic management and particularly opioid management which was a predominate focus for many whilst other analgesic modes were not identified (e.g. non-steroidal anti-inflammatories). Similarly, although there is a growing trend for specialist follow-up services after major trauma, this service remains aspirational for many trauma networks. For this reason, scoring within the follow-up categories was lower and the statements were excluded after round two. For most participants, the need for greater, clearly written discharge information was very important. This highlights the potential of a Major Trauma Passport with patient specific information which may be used in different healthcare settings during post discharge recovery. Finally, although statements relating to physical health and frailty were included, there was a paucity of care component specific to patients with comorbidities and multi-comorbidities. It is understood that these have a substantial impact on safe hospital discharge, and it continues to be important to ensure that care pathways include a holistic and comprehensive approach to care planning.

In the development of patient pathway-based interventions, selection of the most appropriate pathway components is a key part of the process. Within BTI management, this is often undertaken using a process of evidence review, particularly where experimental research has demonstrated the effectiveness of intervention components [26]. Unfortunately, in many areas of major trauma care, where the development of the evidence base is an ever-evolving continuum, there are components of care which are embedded in practice despite low levels of evidence [3]. An example of this can be seen in the implementation of Incentive Spirometry in BTI patients in some centres, without the support of specific trauma related evidence of effectiveness [18].

It is important to remember that pathway-based interventions are innately complex due to the multiple independent components that interact within any pathway [3]. This also makes evaluation challenging as the efficacy of these pathway-based interventions is affected by external factors such as the environment it is implemented in and the method behind its implementation [27,28]. This can result in pathways working in some settings and not in others. Therefore a 'one fit' approach is unlikely to work, and in fact giving sites the toolkit to build a locally effective pathway is the key to success in this situation [3,29]. In future research we need to think about the evaluation of both individual interventions/components used in the management of BTI and the experimental evaluation of pathway-based interventions [30]. Having a greater understanding of the working processes of multiple interventions within a pathway will allow substantially increased flexibility in the development of future pathways [29,31].

There are a few key stages that follow this in the pathway development process. Firstly, the statements will be constructed into a framework, which in turn will be used to develop a pathway 'toolkit.' This document will supply the essential pathway components from which different centres can develop their own local pathway [32]. Prior to the pathway toolkit being available exter-

Table 2
Final Statements for inclusion in the discharge pathway toolkit.

Statements NB. Consensus level achieved denoted by *	Median (IQR)	Low Importance (1-2)	Moderate Importance (3-4)	High Importance (5-6)	Unable to Score
Discharge criteria					
Pain VAS score is <3 whilst resting and <5 when mobilising (n=45)	5 (1)	0%	20.0%	77.8%*	2.2%
Oxygen saturation levels within normal patient parameters (n=45)	6 (1)	0%	4.4%	95.6%*	0%
Advanced and regional analgesic agents successfully ceased for 12-hours (n=45)	5 (1)	0%	6.7%	93.3%*	0%
Discharge analgesic plan in place and medications available for patient to take home (n=45)	6 (0)	0%	0%	100%*	0%
Patient can manage their personal hygiene +/- aids or with carer support (n=45)	5 (1)	0%	17.8%	82.2%*	0%
Patient is no longer requiring any ventilation support or oxygen therapy (n=45)	6 (0)	0%	2.2%	97.8%*	0%
No signs or symptoms of untreated chest infection/other respiratory complications (n=45)	5 (1)	0%	22.2%	77.8%*	0%
Physical function and self-care:					
Patients with altered mobility and those in high risk groups (e.g. elderly) should have a documented mobility assessment prior to discharge from hospital (n=44)	5 (1)	0%	20.5%	79.5%*	0%
Where clinically appropriate, an assessment of risk for poor physical functional outcomes (i.e. mobility and self-care) should be completed prior to discharge from hospital (n=44)	5 (1)	0%	27.3%	72.7%*	0%
Patients at high risk of poor physical functional outcomes should be referred to a community or outpatient therapies team (PT/OT) prior to discharge from hospital (n=44)	5 (1)	0%	15.9%	84.1%*	0%
Where appropriate, assessment should include home care needs, including the patient's ability to care for themselves and complete Activities of Daily Living (n=44)	5 (1)	0%	9.1%	90.9%*	0%
All patients should be educated on basic self-administered physiotherapy exercises (i.e. shoulder girdle exercises, active cycle breathing techniques) prior to discharge from hospital (n=44)	5 (2)	2.3%	25.0%	72.7%*	0%
Where appropriate, the MDT will facilitate a discussion (either formally or informally) to identify patients' expectations of the discharge process (n=44)	4 (1)	9.1	77.3%*	13.6%	0%
All patients over the age of 65 years should be assessed using a ratified frailty assessment tool during hospital admission and where frailty needs are identified, patients should be assessed by a specialist frailty clinician (n=44)	5 (2)	2.3%	22.7%	72.7%*	2.3%
Pain management components:					
All patients should have a clearly documented analgesic management plan prior to discharge from hospital (n=43)	6 (0)	0%	0%	100%*	0%
All patients should be aware of the medication (inc. pain relief) that they are being discharged home with and how long the medicines supply will last (n=44)	6 (0.7)	0%	0%	100%*	0%
All patients should receive guidance on where, when and how to access further medications from this primary care provider (n=44)	5 (1)	0%	6.8%	93.2%*	0%
All patients should be discharged with a sufficient supply of medication that will last until the patient can reasonably be expected to access further prescription medications (n=44)	6 (1)	0%	0%	97.7%*	2.3%
All patients should be provided with clear instructions on how to use opioid analgesics safely at home including a plan for weaning opioid doses in the community setting (n=44)	5 (1)	0%	6.8%	90.9%*	2.3%
Respiratory function components:					
All patients should have a brief assessment of respiratory function prior to discharge from hospital (n=44)	5 (1)	0%	18.2%	81.8%*	0%
General components:					
For patients who are anticoagulated, this should be reviewed prior to discharge from hospital (n=44)	5 (0)	2.3%	6.8%	84.1%*	6.8%
If injuries sustained relate to interpersonal violence, health promotion advice, and where available, referral to specialist services should be made (with consent from the patient) prior to discharge from hospital (n=44)	5 (1)	0%	9.1%	90.9%*	0%
Follow-up components:					
All patients should be discharged with a comprehensive discharge letter that contains information about all injuries, treatment, ongoing care needs and prescription discharge medications (n=44)	6 (0)	0%	0%	100%*	0%
Psychological care components:					
Patients' potential psychological support needs should be assessed prior to discharge from hospital (n=44)	4 (1)	2.3%	86.4%*	11.4%	0%
All trauma services should have a pathway for accessing psychological support after traumatic injuries (n=44)	5 (1)	4.6%	9.1%	84.1%*	2.3%
Patient, family, and communication:					
Where at all possible, patients should be integrated into discharge decision making processes (n=44)	5 (1)	0%	6.8%	93.2%*	0%
Patients' wishes relating to discharge should be clearly documented and where possible these will be integrated into the discharge planning process (n=43)	5 (1)	0%	14.0%	86.1%*	0%
Patients [and next of kin/primary carers] should be educated in aspects of post discharge self-management prior to discharge from hospital (n=44)	5 (0.8)	0%	6.8%	93.2%*	0%
Red Flags:					
Increased shortness of breath or difficulty in breathing (n=44)	6 (0)	0%	0%	100%*	0%
Pyrexia (n=44)	5 (1)	0%	9.1%	90.9%*	0%
Productive cough and/or increased sputum loading (n=43)	5 (1)	0%	2.3%	97.7%*	0%
Uncontrolled pain/pain that does not resolve within 6-weeks of discharge (n=44)	5 (1)	2.3%	22.7%	75.0%*	0%
Increased analgesic use/requirements (n=44)	5 (1)	0%	15.9%	84.1%*	0%
Dizziness/pre-syncope (n=44)	5 (1)	2.3%	27.3%	70.5%*	0%
Signs of Venous Thromboembolism (n=44)	5 (1)	0%	4.5%	91.0%*	4.5%
Poor range of movement at the shoulder girdle/thorax (n=44)	4 (0)	11.4%	81.8%*	6.8%	0%
New constipation (related to opioid use) (n=44)	4 (0)	9.1%	75.0%*	13.6%	2.3%
New confusion (n=44)	5 (1)	0%	4.5%	95.5%*	0%
Decreasing/decreased exercise tolerance (n=44)	4 (0)	2.3%	77.3%*	20.5%	0%
Impaired cough effectiveness (n=44)	5 (1)	0%	29.5%	70.5%*	0%

Table 3
Summary of statements excluded in round 2 & 3.

Theme:	Pathway statements not achieving consensus (Round 2)	Pathway statements not achieving consensus (Round 3)
Discharge Criteria:	FEV1 normalised.	Patient can transfer and mobilise independently +/- aids or is back to their pre-injury baseline mobility.
	Bowels open normally within the last 24 hours.	Patient is compliant with basic self-administered physiotherapy (e.g. deep breathing, cough, shoulder girdle exercises). The patient is in agreement with the discharge plan.
Physical Functioning and Self-Care components:	An assessment of exercise tolerance should be included in the mobility assessment of patients prior to discharge from hospital. Where the need for home adaptations (i.e. aids and equipment) are required these should be in place before the decision to discharge is confirmed. Where appropriate, the MDT will facilitate a discussion to identify potential challenges and solutions to facilitators and barriers to successful recovery in the early post discharge period prior to hospital discharge.	Nil
Pain management components:	For all patients referred to specialist pain services, the post discharge pain management plan should be agreed with a pain clinician prior to discharge from hospital. Where appropriate, an assessment of risk for unresolved chronic pain and/or neuropathic pain at six-month after discharge should be completed prior to discharge. Patients with high risk of either unresolved chronic pain or neuropathic pain at 6 months after discharge should be referred to a community or outpatient specialist pain services prior to discharge from hospital. Patients with low risk for either unresolved chronic pain or neuropathic pain at 6 months after discharge should have pain related follow-up with their primary care provider. All patients should have a self-reported VAS pain score documented (at rest and when mobilising) prior to discharge from hospital.	All patients with complex acute pain needs should be reviewed by a specialist pain clinician prior to discharge from hospital. All discharge pathway should consider the key indicators for commencing neuropathic pain medication prior to hospital discharge. All patients should be assessed for risk factors associated with opioid addiction prior to discharge with opioid analgesia. Pain management plans should include non-pharmacological techniques for managing pain (e.g. splinting when coughing).
Respiratory function components:	Where incentive spirometry has been commenced during the inpatient admission, this should be continued in the early post discharge period. All patients should have lung function testing (spirometry) prior to discharge from hospital.	Where abnormal lung function has been identified during the inpatient admission, patients should be referred to an outpatient respiratory service prior to discharge from hospital. All patients should be educated on the techniques and importance of basic self-administered airway clearance and volume expansion exercises (e.g. active cycle breathing technique) prior to discharge from hospital.
General components:	Nil	Where patients have experienced weight loss during hospital admission, a nutritional assessment should be conducted prior to discharge from hospital. Where appropriate and with the patient's consent, referrals to a community smoking cessation service should be made prior to discharge from hospital. Where alcohol dependence and/or other substance misuse has been identified during inpatient admission, health promotion advice should be provided including referral to a specialist service (with the consent of the patient) prior to discharge from hospital.
Follow-up components:	All patients should have a comprehensive review in a post major trauma out-patient clinic during the early post-discharge period. All patients should have a comprehensive review of ongoing care needs with their primary care provider within 2 weeks of discharge from hospital.	Where ongoing medical needs are identified, patients should have a comprehensive review (remote or face-face) in a post major trauma out-patient clinical (or with their primary care provider if OPD is not available) during the early post discharge period.

(*continued on next page*)

Table 3 (*continued*)

Psychological support needs components:	Nil	Where clinically indicated, patients should be given information on available psychological services within the trauma network prior to hospital discharge.
The patient, family and communication:	Nil	Where appropriate and with the patient's consent, the next of kin/primary carer should be involved in discharge planning.
'Red Flag' Signs	Nil	Falls without previously identified risk. Unable to lie flat due to injury related symptoms. Worsening of any injury related symptom. Nausea and vomiting after opioid use in the early post discharge period. Evidence (clinical or anecdotal) of bleeding.

nally, the content will undergo an external review process whereby external specialist and patient groups can provide comments on different aspects of the project, including validity, applicability, usefulness of results and adequacy of methodology for pathway development [33]. The final step will be to develop a draft pathway that can be used to illustrate the process locally. After being released, each centre developing and implementing this pathway model will need to complete local levels of pathway/guideline approval, local validation, regular retrospective audit and evaluation of the pathways function at a local level [34].

Strengths and limitations

There are several limitations commonly found within Delphi studies that need to be acknowledged. Firstly, the high level of participant time burden associated with the method is likely to have impacted on the rate of response amongst these study participants. As per previous studies, it is likely that the first round being open questions with free text boxes may have been off-putting for some participants. Overall, the participation rates seen within this study were similar to other Delphi studies undertaken with comparable populations and topic areas [21,35]. Due to the anonymous submission of surveys by participants, it was not possible to analyse how many participants completed all rounds of this Delphi study. It was therefore not possible to analyse whether there would be a more stable consensus within this group of participants, although it is acknowledged that this would provide further insight into the level and stability of consensus achieved across all Delphi statements. Furthermore, it would have been interesting to explore further why some statements did not achieve consensus within the study, as this may highlight a need for further education within the major trauma interdisciplinary team. Overall, as the evidence base grows stronger, there will be greater evidence to support and underpin these components of BTI care.

Secondly, there is no best practice guidance available on what constitutes an expert within the Delphi method. This makes selection of a Delphi panel very challenging. In this study, participants were asked to sign-up without assessment of suitability but for purposes of transparency, the demographic characteristics of the sample within each round are presented within the study allowing readers to interpret the level of expertise within the panel for themselves. In the study we had a good mix of different professional groups with different speciality areas within trauma care. Although several participants had less than 2 years' experience in their professional role, they would have practical experience in discharging trauma patients within this time and therefore had important experience to impute into the consensus process that more experienced participants may not have. Overall having a broad range of experiences and differences in participants characteristics increases the chance of achieving a true consensus through this process. As the sample works to achieve the consensus, the strength of the Delphi method lies in the group level data within the sample and not the individuals contained with the sample. Care was taken by the authors to only engage in non-participant roles within the consensus exercise to ensure that the knowledge and beliefs of these individuals did not influence the scoring or views of any participants.

Data collection for this Delphi study was undertaken during the evolving Covid-19 pandemic and although there has been no identifiable impact on the methodological processes within and the results presented, it remains possible that Covid-19 effected this study in unseen ways. As maintaining emergency care research during the pandemic has been challenging it is important to consider what hidden bias may be inherent from the events of 2020 [36]. It is important to note that there were some important professional groups not represented within the Delphi expert panel including occupational therapists and pharmacists and these disciplines would have had important roles in the consensus building exercise. Although this cannot be automatically attributed to Covid-19, the result of the changing priorities of the healthcare workforce in 2020 cannot be under-estimated.

Conclusions

These data will be used to develop a new discharge pathway framework which aims to optimise patient recovery at home in the early post discharge period. Further investigation on the effectiveness of this pathway framework will be undertaken in future empirical research. For some members of the expert consensus panel, there will be statements that have been excluded that they might consider to be vital in the safe discharge process. This process is about identifying the core essential pathway components, from which different sites and centres can develop individual pathways and add additional components from outside the BTI discharge pathway framework. Although these pathways may look different depending on the services available locally, they will all be underpinned by a framework of core statements/components. It is hoped that this will help standardise the process and influence the thinking of clinicians managing BTI discharge to consider how the discharge process can affect post discharge self-management.

Declarations

Ethical approval and consent to participants

Ethics approval for this Delphi study was obtained from King's College London College Research Ethics Committee (Psychiatry, Nursing and Midwifery committee) through minimal risk registration (MRSP-19/20-19847) and approval was given on 19/06/2020. Consent for participation was assumed from the submission of the anonymised survey in each Delphi round.

Consent for publication

Not applicable.

Availability of data and material

Please contact author for data requests.

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Authors contributions

EB, AX, CN, PH & GL conceived this study, designed the tool and protocol. GL, AX, CN & PH are EB's academic supervisor at King's College London. Data collection was undertaken by EB. Initial analysis and data integration were undertaken by EB. EB undertook the initial draft of the manuscript, and CN, PH, GL contributed substantially to subsequent drafts and revisions. All authors approved the final version of the manuscript. EB takes responsibility for the paper.

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Declaration of Competing Interest

The authors declare that they have no competing interests.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.injury.2021.03.061.

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